HEATHKIT®
MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN

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If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center, or any of our authorized overseas distributors.

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This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for accidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you are not satisfied with our service (warranty or otherwise) or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

HEATH COMPANY
BENTON HARBOR, MI. 49022

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

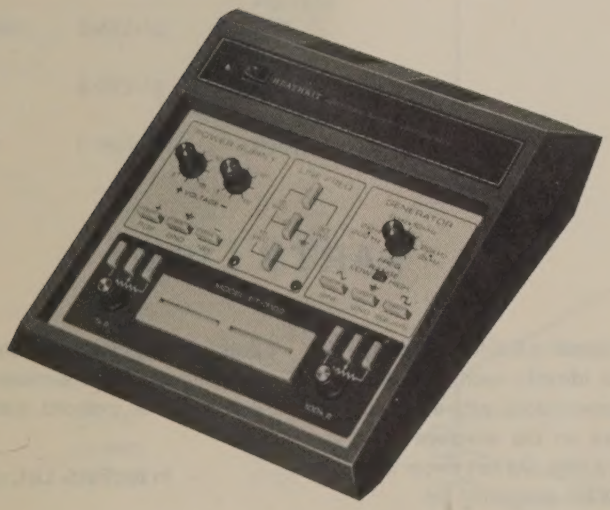
Heathkit® Manual

for the

ELECTRONIC DESIGN EXPERIMENTER

Model ET-3100

595-1734-06



Introduction 2
Parts List 2
Step-by-Step Assembly
Assembly Notes 8
Alternate Line Voltage Wiring 18
Final Wiring 19
Test and Adjustments 21
Final Assembly 21
Operation and Applications 24
In Case of Difficulty 26
Troubleshooting Chart 27
Specifications 28
Circuit Description 29
Circuit Board X-Ray View 31
Voltage Chart 32
Identification Chart 33
Schematic ..... In Illustration Booklet
Warranty ..... Inside front cover
Customer Service ..... Inside rear cover

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INTRODUCTION

The Heathkit Model ET-3100 Electronic Design Experimenter is a compact, rugged, reliable, and versitile design instrument. With it, you can quickly build and test circuits that you have designed or want to experiment with.

The ET-3100 is also an excellent learning tool and is a recommended supplement to the individual learning programs of Heathkit Continuing Education.

The Experimenter has the following built-in features:

- Variable and regulated, positive, 1 to 15 volt DC power supply.
- Variable and regulated, negative, 1 to 15 volt DC power supply.
- 200 Hz to 20 kHz signal generator, with sine wave and square wave outputs.
- Two 60 Hz sine wave signal sources (15 volts and 30 volts).
- Large breadboarding socket.
- A 1000 Ω and a 100 kΩ experimentation potentiometer.

Most of the components are mounted on the circuit board. This makes the kit easy to assemble. The compact size and light weight allow you to move or place the Experimenter almost anywhere.

PARTS LIST

Check each part against the following list. Make a check (✓) in the space provided as you identify each part. Any part that is packed in an individual envelope with a part number on it should be placed back in the envelope after you identify it until called for in a step. Do not throw away any packing material until all parts are accounted for.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual. For pricing information, refer to the separate "Heath Parts Price List."

Each circuit part in this kit has its own component number (R2, R4, etc.). Use these numbers when you want to positively identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

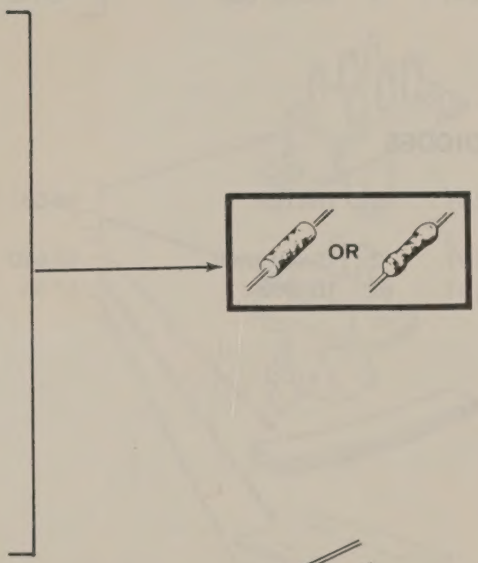
- In the Parts List,
- At the beginning of each step where a component is installed,
- In some illustrations,
- In the Schematic,
- In the sections at the rear of the Manual.

QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

RESISTORS, 1/4-Watt

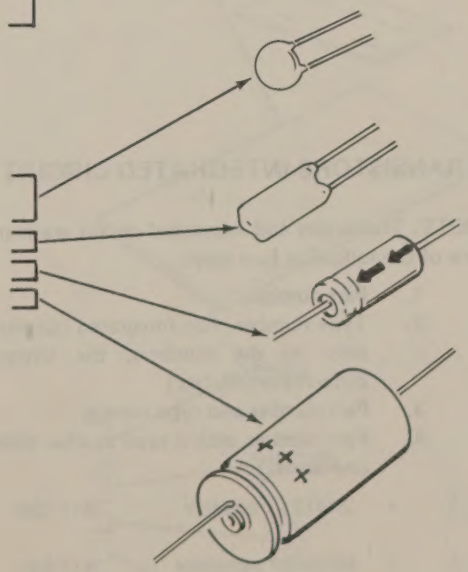
NOTE: The following resistors have 5% tolerance and have a gold fourth band.

( ) 2	4.7 Ω (yellow-violet-gold)	6-479-12	R107, R117
( ) 2	47 Ω (yellow-violet-black)	6-470-12	R12, R13
( ) 2	220 Ω (red-red-brown)	6-221-12	R104, R114
( ) 1	560 Ω (green-blue-brown)	6-561-12	R15
( ) 2	1000 Ω (brown-black-red)	6-102-12	R14, R4
( ) 1	2200 Ω (red-red-red)	6-222-12	R18
( ) 5	3300 Ω (orange-orange-red)	6-332-12	R2, R3, R8, R9, R16
( ) 1	4700 Ω (yellow-violet-red)	6-472-12	R17
( ) 1	27 kΩ (red-violet-orange)	6-273-12	R101
( ) 2	56 kΩ (green-blue-orange)	6-563-12	R105, R115



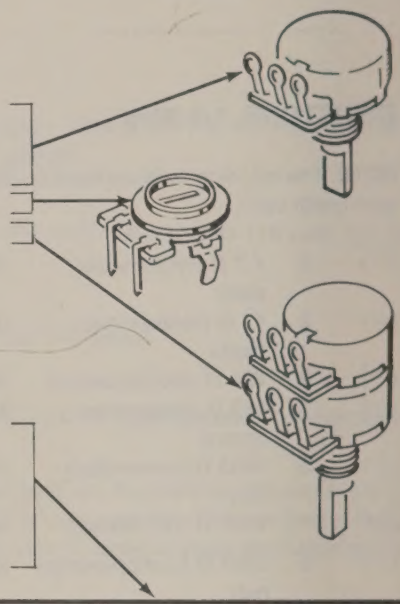
CAPACITORS

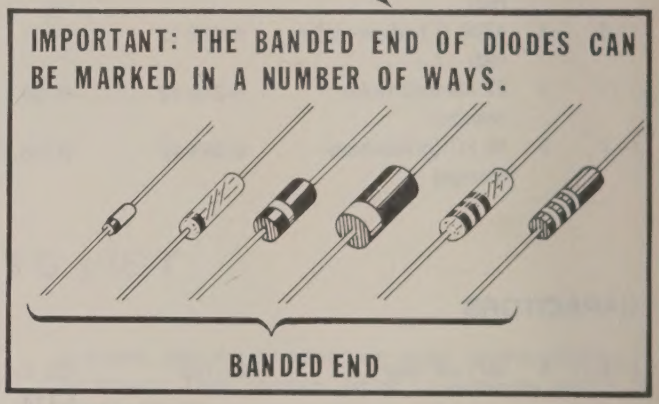
( ) 4	.001 μF disc	21-163	C2, C4, C103, C113
( ) 2	.01 μF Mylar*	27-74	C1, C3
( ) 2	10 μF electrolytic	25-865	C102, C112
( ) 2	1000 μF electrolytic	25-876	C101, C111



*DuPont Registered Trademark.

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
CONTROLS				
( )	1	1000 Ω (1K)	10-1054	R122
( )	2	3000 Ω	10-1053	R106, R116
( )	1	100 kΩ	10-1055	R121
( )	1	1000 Ω	10-391	R4
( )	1	100 kΩ dual	12-146	R1/R5
DIODES				
( )	5	1N4149	56-56	D1, D2, D3, D106, D107
( )	2	15-volt zener	56-620	ZD101, ZD102
( )	4	1N4002	57-65	D101, D102, D104, D105



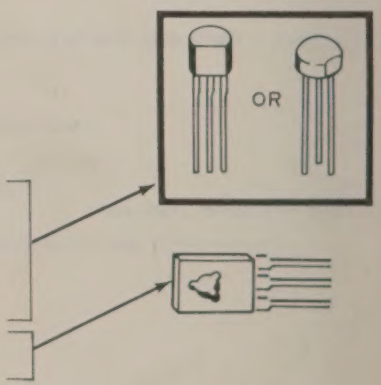


TRANSISTORS-INTEGRATED CIRCUIT

NOTE: Transistors and integrated circuit are marked for identification in one of the following four ways:

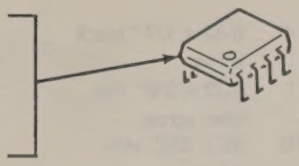
1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers, the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

( )	4	2N4121 transistor	417-235	Q2, Q105, Q107, Q108
( )	6	MPSA20 transistor	417-801	Q1, Q3, Q4, Q101, Q103, Q104
( )	1	MJE181 transistor	417-818	Q102
( )	1	MJE171 transistor	417-819	Q106



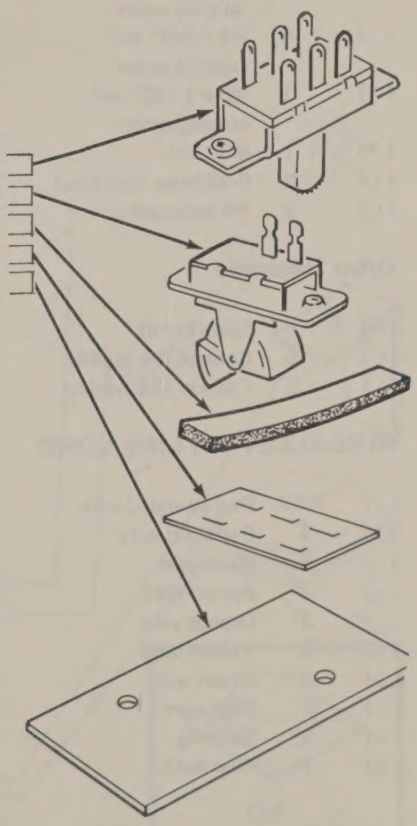
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.

TRANSISTORS—INTEGRATED CIRCUITS (cont'd.)



( )	1	N5741V or MC1741CPI or μA7417C or LM741CN integrated circuit	442-22	IC1

SWITCHES-INSULATORS

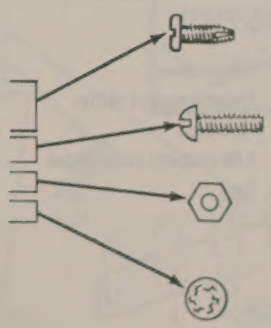


( )	1	DPDT slide switch	60-78	SW1
( )	1	SPST rocker switch	60-607	SW101
( )	1	Foam tape (5" x 3/4")	73-92	
( )	1	Switch insulator	75-52	
( )	1	Insulator plate	75-724	

HARDWARE

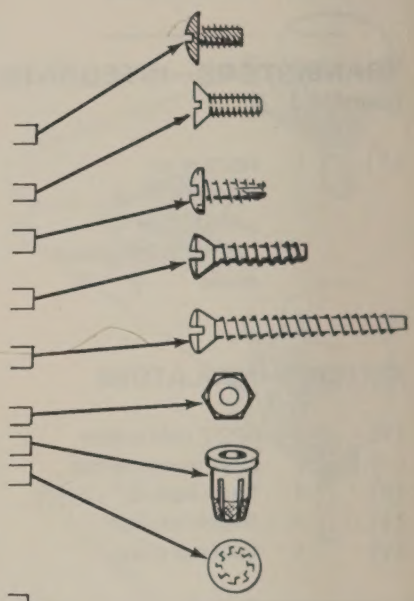
NOTE: The hardware may be in more than one packet. Open all the hardware packets before you check the hardware against the Parts List.

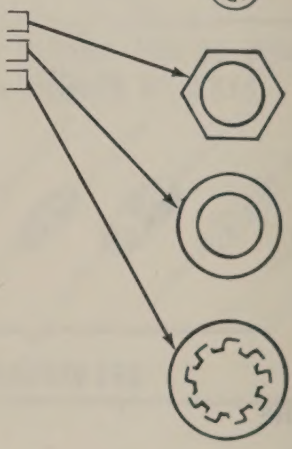
#4 Hardware

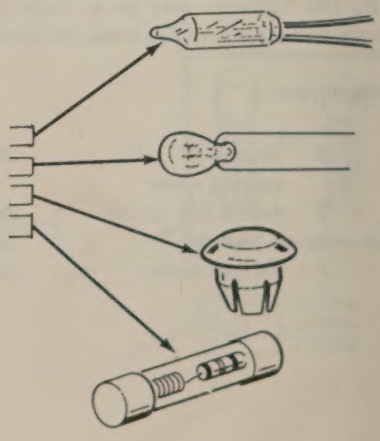


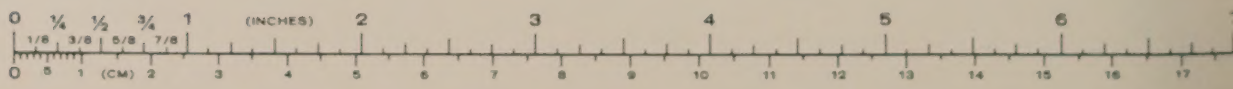
( )	3	#4 x 5/16" self-tapping screw	250-163
( )	2	4-40 x 3/8" screw	250-4
( )	2	4-40 nut	252-2
( )	2	#4 lockwasher	254-9

QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
#6 Hardware			
4	6-32 x 1/4" black screw	250-116	
1	6-32 x 3/8" flat head screw	250-32	
10	#6 x 3/8" self-tapping screw	250-592	
8	#6 x 5/8" self-tapping screw	250-559	
2	#6 x 1-1/8" self-tapping screw	250-1137	
1	6-32 nut	252-3	
2	6-32 brass insert nut	252-170	
2	#6 lockwasher	254-1	
Other Hardware			
5	Control nut	252-7	
5	Control flat washer	253-10	
5	Control lockwasher	254-4	
WIRE-SLEEVING-LINE CORD			
2'6"	Red stranded wire	344-21	
5'	Red solid wire	344-52	
5'	Black wire	344-50	
3'	Brown wire	344-51	
3'	Orange wire	344-53	
5'	Yellow wire	344-54	
3'	Green wire	344-55	
3'	Blue wire	344-56	
6"	Sleeving	346-1	
1	Line cord	89-49	
LAMPS-LENS-FUSE			
1	Neon lamp	412-15	PL101
1	Incandescent lamp	412-83	L1
1	Red lens	413-15	
1	1/8-ampere slow-blow fuse	421-26	F101

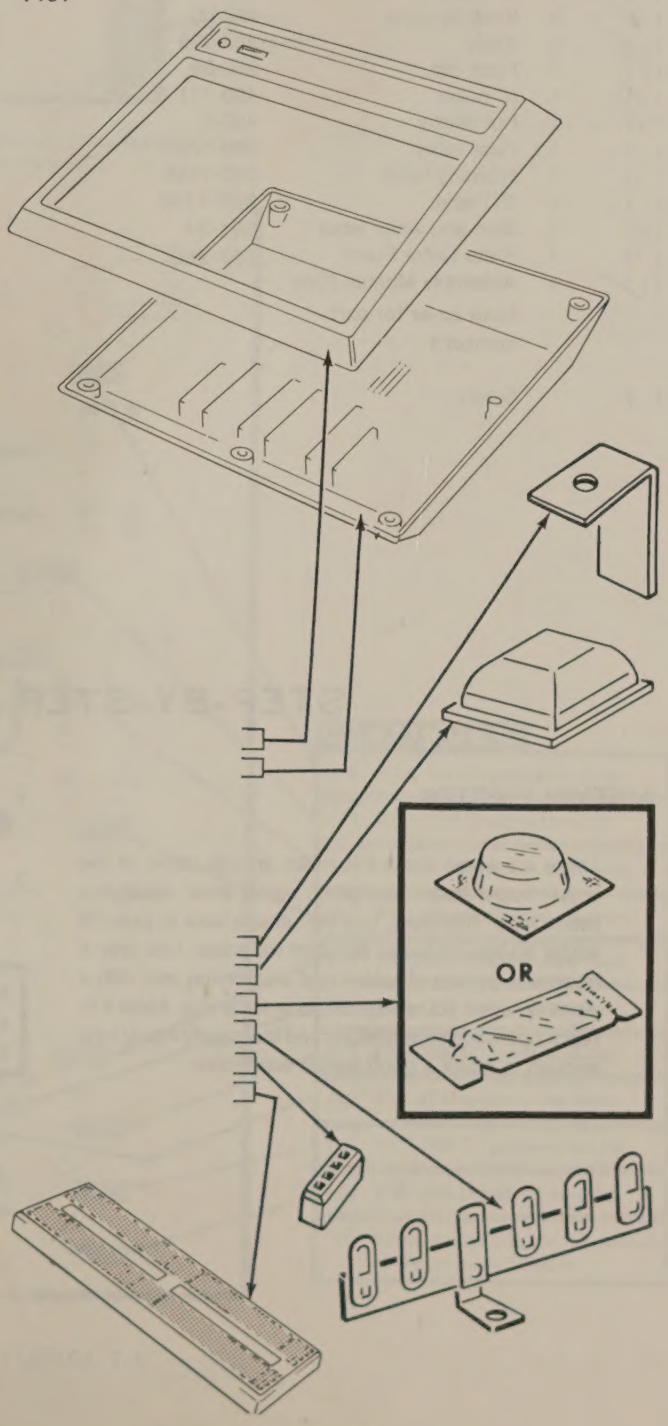




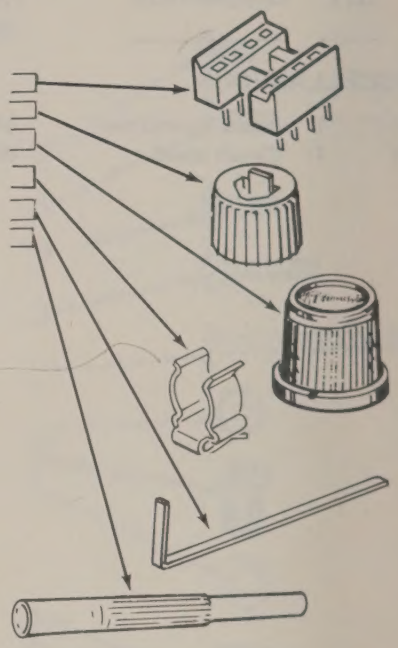




QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
MISCELLANEOUS			
1	Power transformer	54-892	T101
1	Circuit board	85-1596-2	
1	Cabinet top	92-611	
1	Cabinet bottom	92-612	
2	Heat sink	215-99	
4	Plastic foot	261-34	
1	Silicone grease	352-13	
1	Terminal strip	431-86	
15	Connector block	432-874	
1	Breadboarding socket (with vinyl strip and connectors)	432-875	



	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
Miscellaneous (cont'd.)				
(✓)	1	IC socket	434-230	
(✓)	5	Knob bushing	455-50	
(✓)	5	Knob	462-399	
(✓)	2	Fuse clip	260-56	
(✓)	1	IC puller	490-111	
(✓)	1	Nut starter	490-5	
( )	1	Fuse label	390-1255	
( )	1	Warning label	390-1135	
( )	1	ETI label	390-1136	
(✓)	1	Blue and white label	391-34	
( )	1	Parts Order Form	597-260	
(✓)	1	Assembly Manual (See front cover for part number.)		
( )		Solder		



STEP-BY-STEP ASSEMBLY

ASSEMBLY NOTES

1. There are some small foil areas around some of the circuit board holes, and there some small areas between foils. Therefore, use the utmost care to prevent solder bridges between adjacent foil areas. Use only a minimum amount of solder and a soldering iron with a small tip when you solder these small areas. Allow it to reach operating temperature, and then apply it only long enough to make a good solder connection.

2. Resistors will be called out by their resistance value in Ω, kΩ, or MΩ, and color code.

3. Capacitors will be called out by their capacitance value (in pF or μF) and type (disc, mica, or electrolytic).

SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so the ends cannot fly toward your eyes.

IDENTIFICATION DRAWING

The steps performed in this Pictorial are in this area of the circuit board.

START

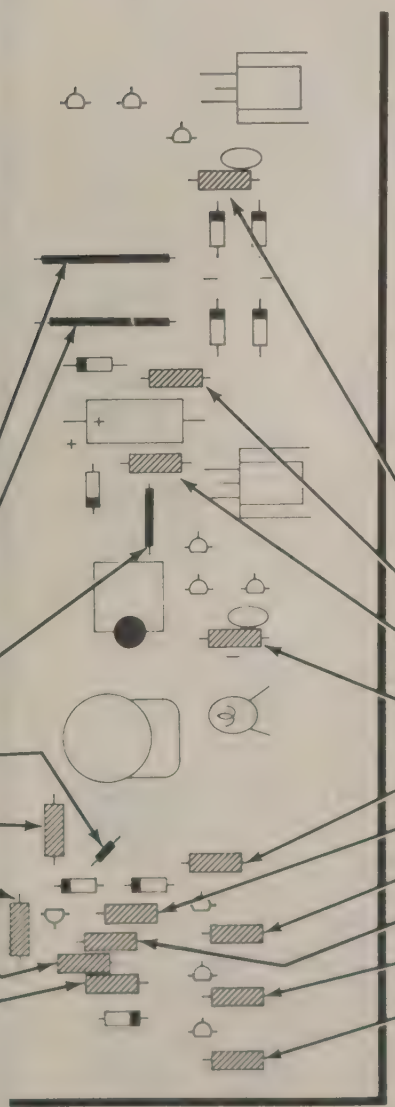
Position the circuit board foil-side-down and as shown in the identification drawing at the top of the page. Then complete each step on the Pictorial.

When a wire is called for, cut a yellow wire to the specified length. Then remove 1/4" of insulation from each end. Solder each wire end to the foil as you install it and cut off the excess wire ends.

- ( ) 1-1/2" wire.
- ( ) 1-1/2" wire.
- ( ) 1" wire.
- ( ) 1" wire. Remove all the insulation from the wire.
- ( ) R9: 3300 Ω (orange-orange-red).
- ( ) R14: 1000 Ω (brown-black-red).
- ( ) R15: 560 Ω (green-blue-brown).
- ( ) R16: 3300 Ω (orange-orange-red).

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.** WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

- ( ) Solder the leads to the foil and cut off the excess lead lengths.

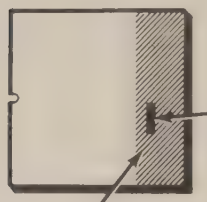


CONTINUE

- ( ) R105: 56 kΩ (green-blue-orange).
- ( ) R114: 220 Ω (red-red-brown).
- ( ) R117: 4.7 Ω (yellow-violet-gold).
- ( ) R115: 56 kΩ (green-blue-orange).
- ( ) R8: 3300 Ω (orange-orange-red).
- ( ) R12: 47 Ω (yellow-violet-black).
- ( ) R11: 1000 Ω (brown-black-red).
- ( ) R13: 47 Ω (yellow-violet-black).
- ( ) R17: 4700 Ω (yellow-violet-red).
- ( ) R18 2200 Ω (red-red-red-gold)
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-1

IDENTIFICATION DRAWING



The steps performed in this Pictorial are in this area of the circuit board.

START

( ) R101: 27 kΩ (red-violet-orange).

( ) R104: 220 Ω (red-red-brown).

( ) R107: 4.7 Ω (yellow-violet-gold).

( ) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.

BANDED END

Install four 1N4149 diodes (#56-56).

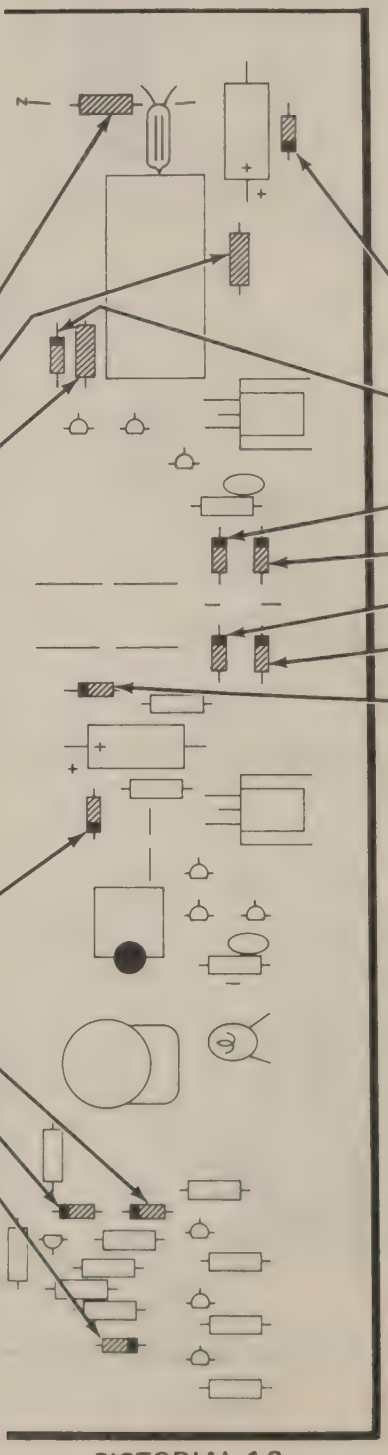
( ) D107. . . . . .

( ) D1. . . . . .

( ) D2. . . . . .

( ) D3. . . . . .

( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) ZD101: 15-volt zener diode (#56-620).

( ) D106: 1N4149 diode (#56-56).

Install four 1N4002 diodes (#57-65).

( ) D105.

( ) D102.

( ) D104.

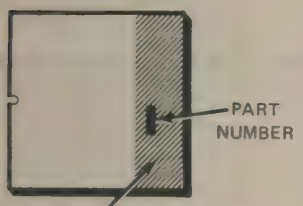
( ) D101.

( ) ZD102: 15-volt zener diode (#56-620).

( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-2

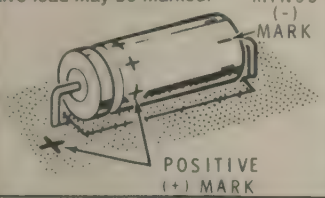
IDENTIFICATION DRAWING



The steps performed in this Pictorial are in this area of the circuit board.

START

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a plus (+) mark or a minus (−) mark near it. **Be sure** to install the positive lead in the positive-marked hole. Be careful; only the negative lead may be marked.



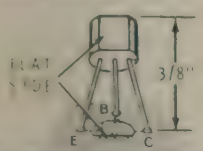
( ) C102. 10 μF electrolytic.

( ) C112. 10 μF electrolytic.

( ) R4. 1000 Ω control.

( ) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install transistors, be sure the top of each transistor is no more than 3/8" above the circuit board. Insert the transistor leads into the corresponding E, B, and C holes in the circuit board as shown. Solder each lead to the foil and cut off the excess lead lengths.

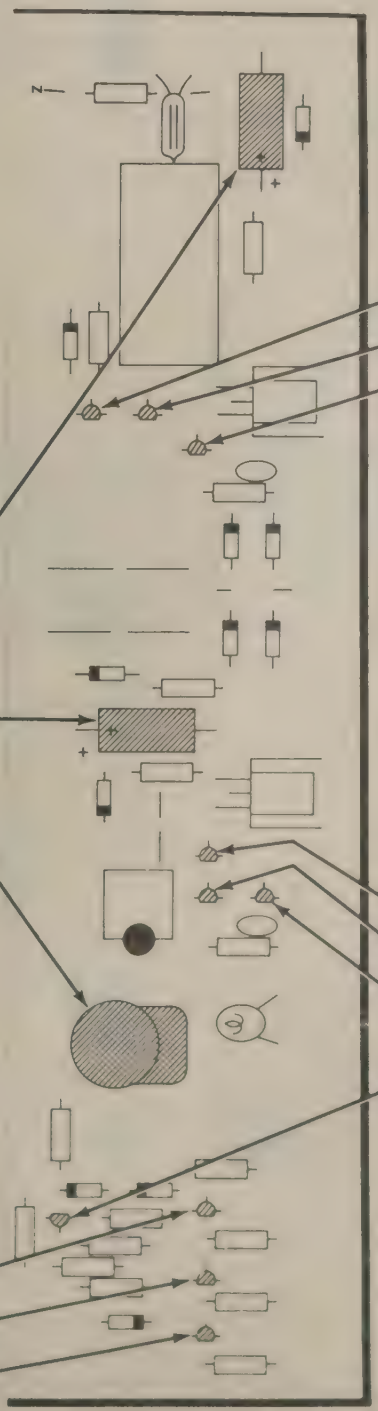


Install three MPSA20 transistors (#417-801):

( ) Q1

( ) Q3

( ) Q4



PICTORIAL 1-3

CONTINUE

Install three MPSA20 transistors (#417-801).

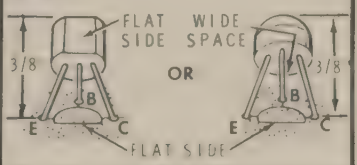
( ) Q103.

( ) Q104.

( ) Q101.

NOTE: Install the next four transistors as shown.

Notice that the transistor shown at the right below must be installed with its wide space opposite to the flat marked on the circuit board with its leads positioned as shown.



Install four 2N4121 transistors (#417-235):

( ) Q108.

( ) Q107.

( ) Q105.

( ) Q2.

NOTE: On Pictorial 1-4 you will install the integrated circuit (IC). If you ever have to remove the IC, use the IC puller supplied with your kit as shown below. Insert its foot beneath the IC; then gently rock the tool back and forth to lift the IC

HEATHKIT

START

NOTE: When you install disc capacitors, remove any excess coating from the leads. Use long-nose pliers to remove the coating.

( ) C103: .001 µF disc.

( ) C113: .001 µF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

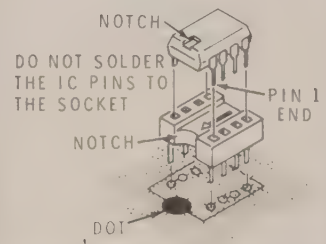
( ) IC1: IC socket and integrated circuit (#442-22).

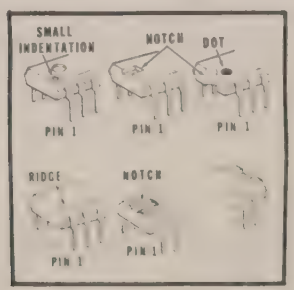
1. Insert the socket pins into the holes. The dot on the circuit board should still be visible after it is installed. Solder the pins to the foil.

2. Refer to Detail 1-4A and identify the pin 1 end of the integrated circuit.

3. Position the pin 1 end of the integrated circuit over the dot on the circuit board.

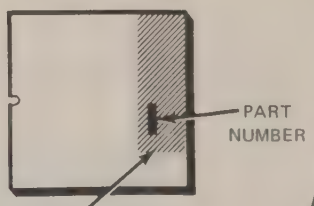
4. Carefully install the integrated circuit. Make sure all of the pins are in their respective holes.



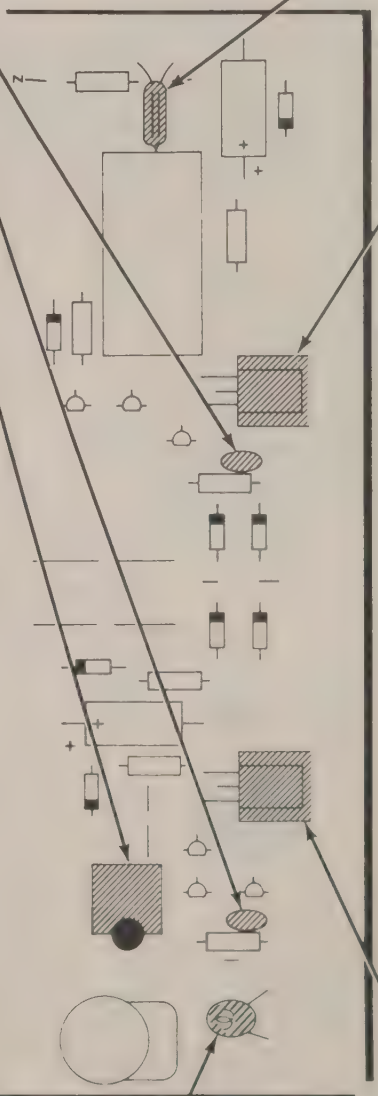


Detail 1-4A

IDENTIFICATION DRAWING



The steps performed in this Pictorial are in this area of the circuit board.



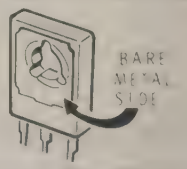
( ) L1: Incandescent lamp. Lay the lamp down on the circuit board, solder the leads to the foil, and cut off the excess lead lengths.

FINISH

CONTINUE

( ) PL101: Neon lamp. Lay the lamp down on the circuit board, solder the leads to the foil, and cut off the excess lead lengths.

( ) Locate the MJE181 transistor (#417-818) and the MJE171 transistor (#417-819). Then open the container of silicone grease and put a liberal amount of grease on the bare metal side of each transistor.

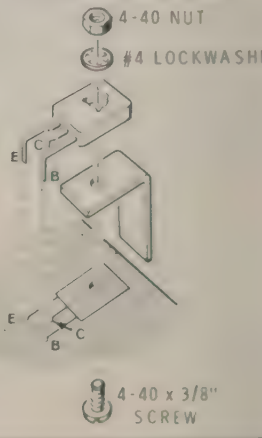


( ) Q102: MJE181 transistor (#417-818) as follows.

1. Position the bare metal side of the transistor down and bend the transistor leads as shown.

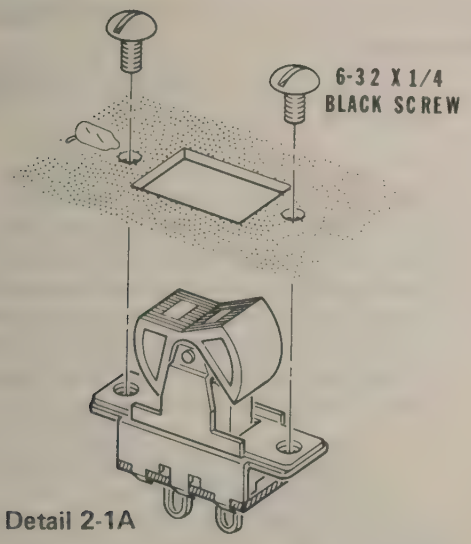
2. Install the E, C, and B leads into the corresponding holes in the circuit board and secure the transistor to the board with a heat sink, 4-40 x 3/8" screw, #4 lockwasher, and 4-40 nut. Use the plastic nut starter to hold and start the nuts on the screws.

3 Solder the leads to the foil and cut off the excess lead lengths.



( ) Q106: MJE171 transistor (#417-819). Install this transistor as you did the previous one.

PICTORIAL 1-4



Detail 2-1A

A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The Step-by-Step Assembly instructions will direct you to the proper illustration in the Booklet. The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the Assembly Manual.

Refer to Pictorial 2-1 (in the Illustration Booklet) for the following steps.

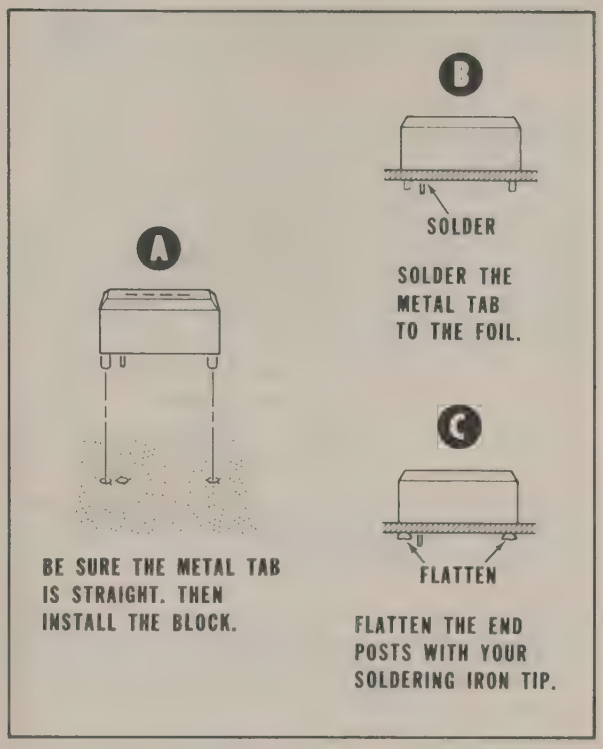
( ) SW101: Refer to Detail 2-1A and mount the SPST rocker switch at SW101 with two 6-32 x 1/4" black screws. Be sure the switch lugs are positioned as shown in Pictorial 2-2 (in the "Illustration Booklet").

NOTE: In some of the following steps, you will solder to large areas of foil. These connections will require more heat. Hold the soldering iron against the connection until the solder flows smoothly onto the foil.

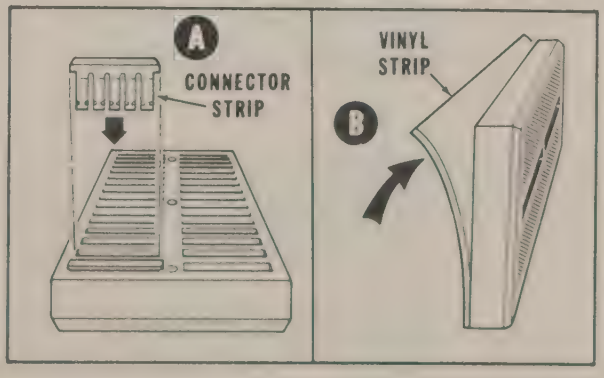
( ) Refer to Detail 2-1B and install connector blocks at the fifteen indicated locations. Make sure each metal tab is straight before you install the connector block.

( ) Refer to part A of Detail 2-1C and install the connector strips, supplied with the breadboarding socket, into the large connector block. You may have some connector strips left over.

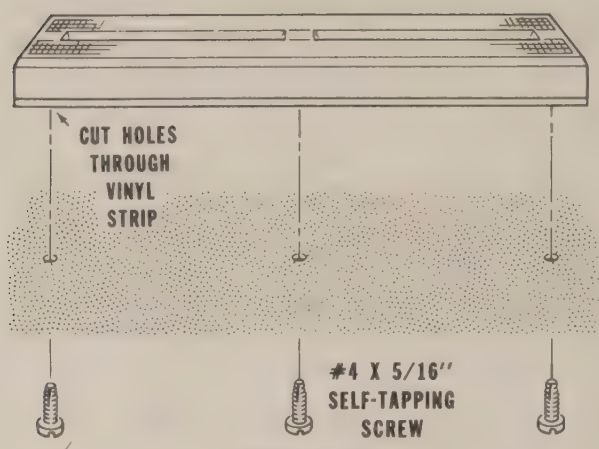
( ) Refer to part B of Detail 2-1C. Then remove the paper backing from the vinyl strip supplied with the breadboarding socket, line up the long edges of the strip and socket as shown, and press the sticky side of the cushion strip against the socket.


A
BE SURE THE METAL TAB IS STRAIGHT. THEN INSTALL THE BLOCK.
B
SOLDER
SOLDER THE METAL TAB TO THE FOIL.
C
FLATTEN
FLATTEN THE END POSTS WITH YOUR SOLDERING IRON TIP.

Detail 2-1B



Detail 2-1C



Detail 2-1D

( ) Refer to Detail 2-1D, cut three holes through the vinyl strip, and mount the breadboarding socket with three #4 x 5/16" self-tapping screws as shown.

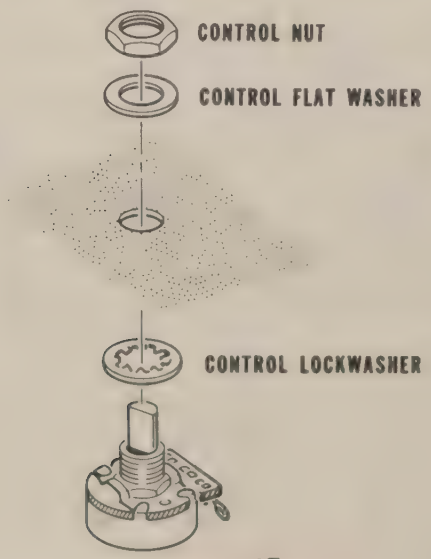
( ) R106: Refer to Detail 2-1E and mount a 3000 Ω control (#10-1053) at R106. Be sure to position the lugs as shown. Use a control lockwasher, a control flat washer, and a control nut.

( ) R116: Mount each of the following controls in a similar manner. 3000 Ω control (#10-1053) at R116.

( ) R122: 1000 Ω (1K) control (#10-1054) at R122.

( ) R121: 100 kΩ control (#10-1055) at R121.

( ) R1/R5: 100 kΩ dual control (#12-146) at R1/R5.

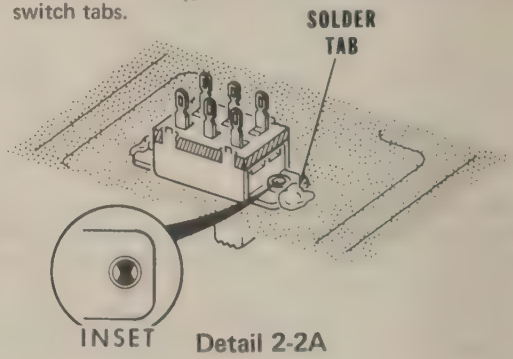


Detail 2-1E

Refer to Pictorial 2-2 (in the Illustration Booklet) for the following steps.

( ) Turn the circuit board upside down and position it as shown in the Pictorial.

( ) SW1: Refer to Detail 2-2A. Then center the foil patterns under the switch tab holes (see the inset drawing) and solder one tab of a DPDT slide switch to the foil at SW1. Use only a small amount of solder at only one spot. Then operate the switch to be sure that it works freely and that the switch knob does not rub against the circuit board. Then finish soldering both switch tabs.



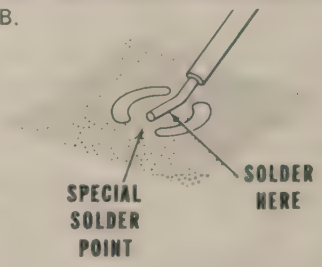
Detail 2-2A

NOTES:

1. When a bare wire is called for, first remove the indicated length of insulation from the yellow wire. Then cut off and use the bare wire.

2. When you solder wires or leads to the foil in the following steps, lay the wire end flat on the foil and solder it to the foil. If the wire tries to spring up off the foil, hold it down with the blade of a screwdriver until the solder cools.

3. On some large areas of the foil, special solder points have been prepared to make soldering easier. Portions of foil have been etched away so solder connections will not require as much heat. When you are instructed to, use these special solder points as shown in Detail 2-2B.



Detail 2-2B

( ) Prepare the following wires:

QUANTITY	LENGTH
2	1" bare
4	1-3/4" yellow

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.

Connect prepared wires to control R122 as follows:

( ) 1" Bare wire from lug 2 (S-1) to foil E (S-1).

( ) 1-3/4" Yellow wire from lug 1 (S-1) to foil D (S-1).

( ) 1-3/4" Yellow wire from lug 3 (S-1) to foil F (S-1).

Connect prepared wires to control R121 as follows:

( ) 1" Bare wire from lug 2 (S-1) to foil B (S-1).

( ) 1-3/4" Yellow wire from lug 1 (S-1) to foil A (S-1).

( ) 1-3/4" Yellow wire from lug 3 (S-1) to foil C (S-1).

( ) Prepare the following yellow wires:

QUANTITY	LENGTH
3	1"
1	2-1/2"
1	2-1/4"
1	1-1/4"

Connect the prepared yellow wires as follows:

( ) 1" Wire from control R106 lug 1 (S-1) to foil T (S-1).

( ) 1" Wire from control R106 lug 2 (S-1) to foil S (S-1).

( ) 2-1/2" Wire from control R106 lug 3 (NS) to control R116 lug 3 (S-1). Position this wire down on the circuit board.

( ) 2-1/4" Wire from control R106 lug 3 (S-2) to special solder point J (S-1).

( ) 1" Wire from control R116 lug 1 (S-1) to foil R (S-1).

( ) 1-1/4" Wire from control R116 lug 2 (S-1) to foil P (S-1).

( ) Prepare a 2-3/4" yellow wire. Remove 3/8" of insulation from one end and 1/4" of insulation from the other end.

( ) Insert the 3/8" bare end of the wire through SW1 lugs 5 and 2, and solder the connections. Connect the free end to foil N (S-1).

( ) Prepare a 2-1/2" and a 1-3/4" yellow wire.

( ) Connect the 2-1/2" wire from control R1/R5 lug 1 (S-1) to foil N (S-1). Another wire was previously soldered at foil N.

( ) Connect the 1-3/4" yellow wire from control R1/R5 lug 4 (S-1) to foil M (S-1).

( ) Locate the two remaining 3300 Ω (orange-orange-red) resistors. Cut one lead of each resistor to 3/4" and the other lead of each resistor to 1/2".

( ) R3: Insert the 3/4" lead of one resistor through control R1/R5 lugs 5 and 6. Solder both connections. Then solder the free lead to foil K (S-1).

( ) R2: Insert the 3/4" lead of the other resistor through control R1/R5 lugs 2 and 3. Solder both connections. Then solder the free lead to foil L (S-1).

( ) C1: Cut one lead of a .01 μF Mylar capacitor to 1/4". Connect this lead to switch SW1 lug 1 (S-1) and connect the other lead to special solder point H (S-1). Then cut off the excess lead length.

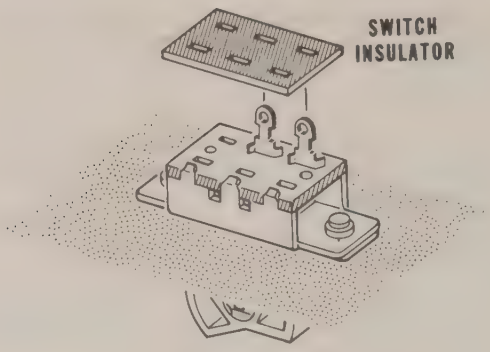
( ) C2: Cut both leads of a .001 μF disc capacitor to 1/2". Connect one lead to switch SW1 lug 3 (S-1) and the other lead to special solder point G (S-1).

( ) Cut two 3/4" lengths of sleeving.

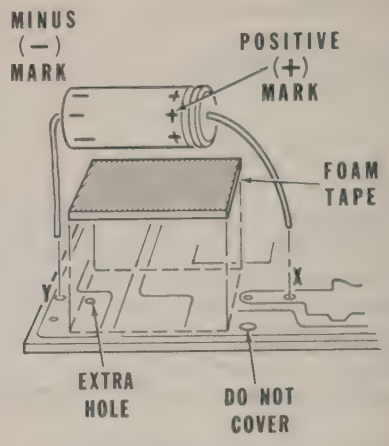
( ) C3: Slide a 3/4" length of sleeving onto each lead of a .01 μF Mylar capacitor. Connect the capacitor from switch SW1 lug 4 (S-1) to foil K (S-1). Another lead has been soldered to this foil.

( ) Cut a 3/4" length of sleeving.

( ) C4: Cut one lead of a .001 μF disc capacitor to 3/8". Connect this lead to switch SW1 lug 6 (S-1). Then slide a 3/4" length of sleeving onto the other lead and connect the lead to foil K (S-1). Two other leads were previously soldered to this foil.



Detail 2-2C



Detail 2-2D

( ) Refer to Detail 2-2C and position the switch insulator down over the lugs of switch SW101.

Prepare the following red stranded wires:

QUANTITY	LENGTH
1	2"
2	8"
1	9"

( ) Twist the bare wire ends of each wire and melt a small amount of solder on each end to hold the small strands together.

NOTE: In some of the following steps, you will install wires in circuit board holes. Leave the wire insulation 1/8" from the circuit board so you can solder the connection. Then lightly tug on the wire to be sure it is properly soldered. See inset drawing on the Pictorial.

( ) Connect one end of the 2" red wire to hole DD (S-1). (This hole is labeled on the top side of the circuit board.) Connect the other end of the wire to switch SW101 lug 1 (NS). Wrap the lead securely around the lug.

( ) Connect an 8" red wire to switch SW101 lug 1 (S-2). Wrap the lead securely around the lug. The free end will be connected later.

( ) Connect the other 8" red wire to switch SW101 lug 2 (S-1). Wrap the lead securely around the lug. The free end will be connected later.

( ) Connect the 9" red wire to hole Z (S-1). The free end will be connected later.

( ) Cut two 1-1/2" lengths of foam tape.

( ) Refer to Detail 2-2D. Then remove the paper backing from one side of one length of foam tape and apply the tape between holes Y and X as shown. Do not cover the indicated large hole. However, you may cover the "extra hole." It will not be used.

( ) In a similar manner, apply the other length of tape between holes W and U. Center it between the holes.

( ) Locate the two 1000 μF electrolytic capacitors and cut each lead to 1".

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a plus (+) mark or a minus (–) mark near it. **Be sure** to install the positive lead in the correct hole. Be careful; only the negative lead may be marked.

( ) C101: Refer to Detail 2-2D, remove the protective paper backing from the foam tape, and install a 1000 μF electrolytic capacitor at holes X (S-1) and Y (S-1) as shown. Be sure to install the positive lead in hole X. Cut off the excess lead lengths on the component side of the circuit board.

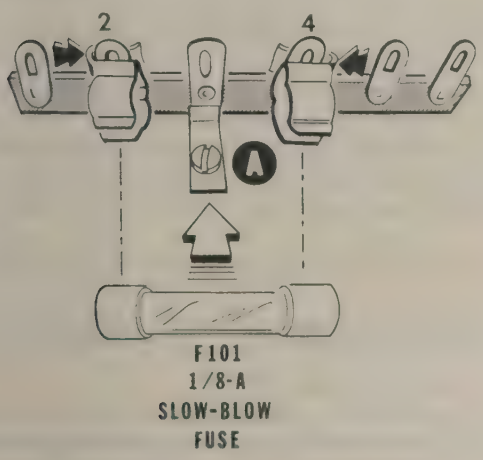
( ) C111: In a similar manner, install another 1000 μF electrolytic capacitor at holes U (S-1) and W (S-1). Be sure to install the positive lead in hole U.

( ) Set the circuit board aside temporarily.

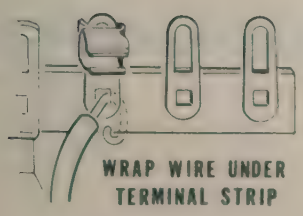
Refer to Pictorial 3-1 (in the Illustration Booklet) for the following steps.

( ) Temporarily mount a 6-lug terminal strip on cabinet post A with a #6 x 3/8" self-tapping screw as shown.

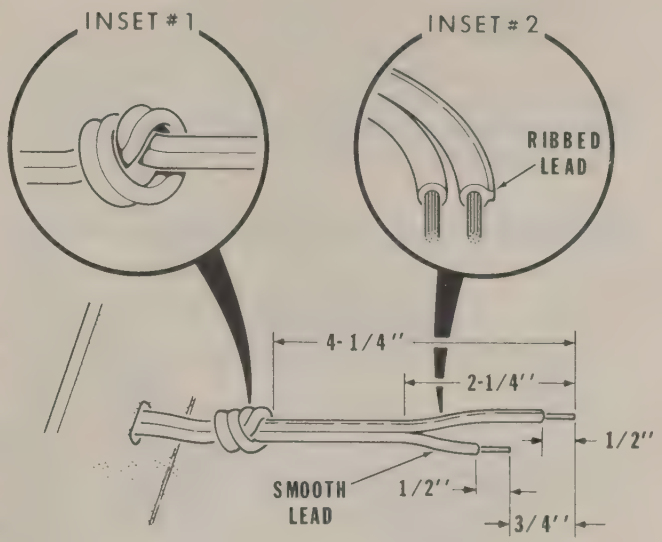
( ) F101: Refer to Detail 3-1A and install two fuse clips and the 1/8-ampere slow-blow fuse at terminal strip A lugs 2 and 4. Then solder the two clips to their lugs. Do not use excessive heat; you may damage the fuse.



Detail 3-1A



Detail 3-1C



Detail 3-1B

( ) Refer to inset drawing #1 on Detail 3-1B, insert the end of the line cord through hole B (from the outside of the case), and tie a knot in the line cord 4-1/4" from the end as shown.

( ) Refer to inset drawing #2 on Detail 3-1B and identify the smooth lead and the ribbed lead of the line cord. Then prepare the end of the line cord as shown.

( ) Tightly twist the bare wire ends and apply a small amount of solder to hold the small strands together.

Connect the line cord leads to terminal strip A as follows. Be sure to make a mechanically secure connection; wrap the lead ends securely under the terminal strip as shown in Detail 3-1C.

( ) Smooth lead to the eyelet below lug 4 (S-1).

( ) Ribbed lead to the eyelet below lug 6 (S-1).

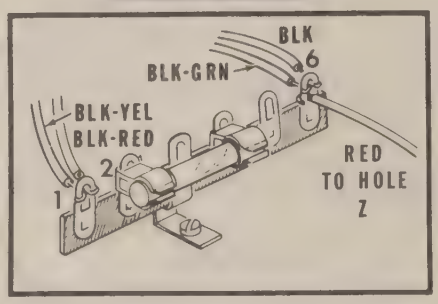
( ) Refer to Detail 3-1D (in the Illustration Booklet) and prepare the transformer leads as shown. Measure the leads from where they come out of the transformer. Remove 1/4" of insulation, twist the bare ends, and apply a small amount of solder to them, if necessary.

( ) T101: Refer to Pictorial 3-1 and install the power transformer (with the red leads up) as shown. Use two #6 x 1-1/8" self-tapping screws.

ALTERNATE LINE VOLTAGE WIRING

Two sets of line voltage wiring instructions are given below, one for 120 VAC and the other for 240 VAC is used. USE ONLY THE INSTRUCTIONS THAT AGREE WITH THE LINE VOLTAGE IN YOUR AREA.

FOR 120 VAC



Detail 3-1E

Refer to Detail 3-1E for the following steps. In these steps, make connections to terminal strip A. Wrap the lead ends tightly at the connections. Connect four of the power transformer leads as follows:

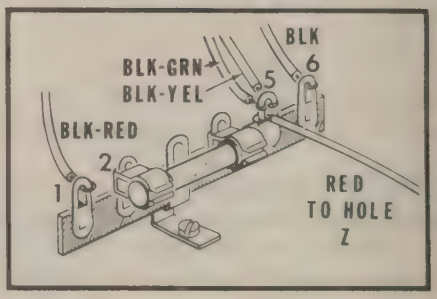
(✓) Black-red and black-yellow leads to lug 1 (NS).

(✓) Black-green and black leads to lug 6 (NS).

(✓) Connect the red wire coming from circuit board hole Z to lug 6 (S-3).

Proceed to "Final Wiring."

FOR 240 VAC



Detail 3-1F

Refer to Detail 3-1F for the following steps. In these steps, make connections to terminal strip A. Wrap the lead ends tightly at the connection. Connect four of the power transformer leads as follows:

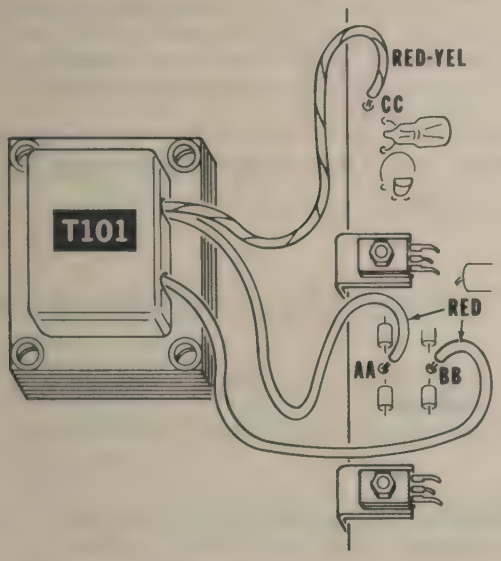
( ) Black-red lead to lug 1 (NS).

( ) Black-yellow and black-green leads to lug 5 (NS).

( ) Black lead to lug 6 (S-1).

( ) Connect the red wire coming from circuit board hole Z to lug 5 (S-3).

Proceed to "Final Wiring."



Detail 3-1G

FINAL WIRING

Refer to Detail 3-1G, turn the circuit board component side up, and connect the remaining transformer leads to the component side of the circuit board as follows:

( ) Red-yellow lead to hole CC (S-1).

( ) Either red lead to hole AA (S-1).

( ) Other red lead to hole BB (S-1).

( ) Turn the circuit board over as shown in Pictorial 3-1.

In the following steps, refer to the Pictorial and connect the free ends of the remaining red wires to terminal strip A as follows. Wrap the lead ends tightly at the connections.

( ) Connect the wire coming from switch SW101 lug 2 to the eyelet of lug 2 (S-1). Route the wire as shown.

( ) Connect the wire coming from switch SW101 lug 1 to lug 1 (S-3). [This is (S-2) if you wired your kit to operate on 240 volts.]

Refer to Pictorial 3-2 (in the Illustration Booklet) for the following steps.

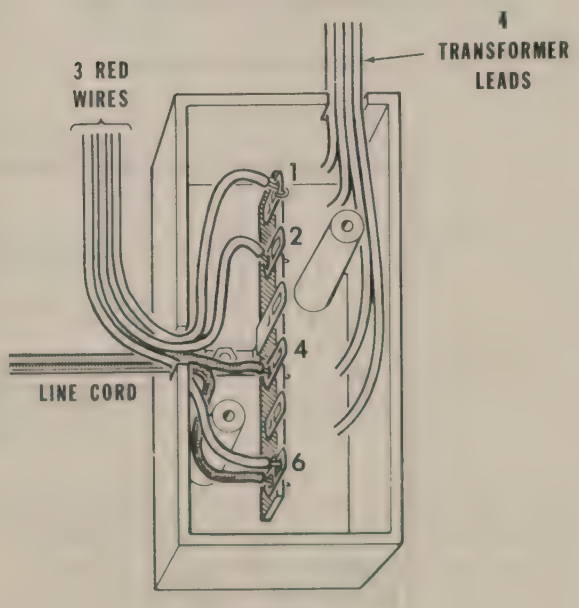
( ) Remove the fuse. Then remove and save the screw you used to secure terminal strip A to the cabinet.

( ) Refer to Detail 3-2A and mount the terminal strip in the box formed in the cabinet bottom as shown. Use a 6-32 x 3/8" flat head screw, two #6 lockwashers, and a 6-32 nut. Then reinstall the fuse.

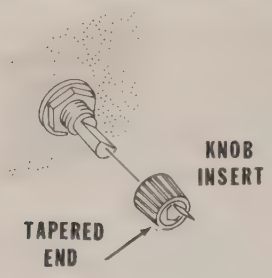
( ) Refer to Detail 3-2B and route the leads and wires as shown.

( ) Mount the insulator plate to the terminal strip box with two #6 x 3/8" self-tapping screws. Do not pinch any wires between the plate and box.

( ) Remove the paper backing from the fuse label and press the label onto the insulator plate. Then write the fuse information on the label (1/8-A, slow-blow).



Detail 3-2B



Detail 3-3A

Refer to Pictorial 3-3 (in the "Illustration Booklet") for the following steps.

( ) Turn the circuit board component side up.

NOTE: Refer to Detail 3-3A and notice that the knob bushing is tapered. When you place one of these bushings on a shaft, be sure the smaller (tapered) end faces out or the knob will not slide onto the bushing. If you are not sure which end is smaller, roll the bushing across a flat surface; the bushing will gradually turn toward the smaller end.

( ) Refer to Detail 3-3A and push knob inserts onto controls R106, R116, R1/R5, R122, and R121.

( ) Turn these controls fully counterclockwise.

( ) Refer to Detail 3-3B and install a knob onto the knob insert on control R106 as instructed in the Detail. Support the back of the circuit board with your fingers, and position the knob pointer toward 1 on top of the circuit board.

Similarly, install a knob on each of the following controls:

( ) R116.

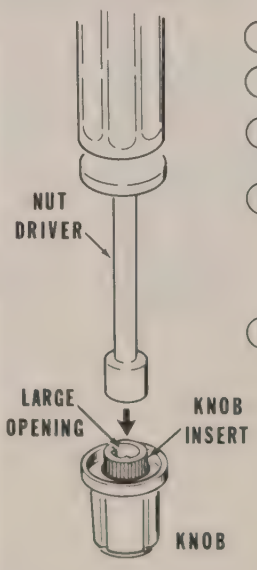
( ) R1/R5. Position the pointer as shown in the Pictorial.

( ) R122. Position the pointer toward the 7 o'clock position.

( ) R121. Position the pointer toward the 7 o'clock position.

( ) Refer to the Pictorial and set the FEEDBACK control (R4) to the center of its rotation as shown.

( ) Set the GENERATOR RANGE switch (SW1) to HIGH.



1. LINE UP THE POINTER AS CALLED OUT IN THE STEP.
2. PUSH THE KNOB PART WAY ONTO THE INSERT
3. CAREFULLY REMOVE BOTH THE INSERT AND THE KNOB. DO NOT ALLOW THE KNOB TO COME OFF THE INSERT.
4. PLACE THE KNOB ON A TABLE OR OTHER FIRM SURFACE. PLACE A SOFT CLOTH UNDER THE KNOB TO PREVENT IT FROM BEING MARRED. THEN USE A NUTDRIVER OR LARGE SCREWDRIVER AND DRIVE THE INSERT INTO THE KNOB.
5. REPLACE THE KNOB ON THE CONTROL FROM WHICH IT WAS REMOVED.

Detail 3-3B

TEST AND ADJUSTMENTS

The purpose of this section of the Manual is to make sure your kit operates properly.

Refer to Pictorial 4-1 (in the Illustration Booklet) for the following steps.

( ) Position the circuit board and cabinet bottom as shown.

( ) Place an insulator (piece of cardboard, etc.) under switch SW101 so the switch lugs cannot touch your work surface.

CAUTION: In the following steps, do not touch the area marked high-voltage area. 120 volts is present here when the line cord is plugged in.

NOTE: If you do not get the proper results in the following steps, unplug the line cord and proceed to the "In Case of Difficulty" on Page 26.

( ) Plug in the line cord plug. Lamp PL101 should light. (If lamp PL101 does not light, push switch SW101 to the other position.)

( ) Lamp L1 should be dimly lit. Adjust the Feedback control, R4, clockwise until the filament of the lamp just stops glowing. Then turn it back counterclockwise until the lamp is again dimly lit.

NOTE: If you have an oscilloscope, connect its vertical input to the SINE connector block and adjust control R4. During this adjustment, the signal may become clipped or amplitude modulated. Adjust R4 for a maximum undistorted signal.

If you have a voltmeter, perform the following steps. If you do not have a voltmeter, proceed to "Final Assembly."

( ) Set your voltmeter to the 15-volts range. Then connect the common lead to the NEG connector block and the other meter lead to the GND connector block. Use short lengths of #22 wire or cutoff component leads to go into the block. See inset drawing.

( ) Adjust the Negative POWER SUPPLY control (R116) from 1 to 15. The voltmeter should indicate from approximately 1 volt to 15 volts.

( ) Connect the common voltmeter lead to the GND small connector block. Connect the other voltmeter lead to the POS small connector block.

( ) Adjust the Positive POWER SUPPLY Control (R106) from 1 to 15. The voltmeter should indicate approximately 1 volt to 15 volts.

( ) Disconnect the voltmeter leads and set the meter aside.

FINAL ASSEMBLY

Refer to Pictorial 4-1 (in the Illustration Booklet) for the following steps.

( ) Disconnect the line cord plug.

( ) Remove the protective backing from the Warning label and apply the label to the cabinet bottom as shown. Install it so the printing is upside down.

( ) In a similar manner, install the blue and white identification label. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

( ) Install a plastic foot in the smooth areas at each of the four corners of the cabinet bottom as shown. First remove the protective backing; then press the foot into place.

Refer to Pictorial 4-2 for the following steps.

( ) Refer to the inset drawing and firmly push a brass insert nut into post D in the cabinet bottom. Push it in as far as it will go.

( ) Push a brass insert nut into post E in the cabinet bottom.

( ) While you hold the edge of one of the brass insert nuts, turn a 6-32 x 1/4" black screw into the nut until the nut anchors solidly in the post. Then remove the screw and anchor the other brass insert nut. Then remove the screw again.

( ) Secure the circuit board to the cabinet top. Use eight #6 x 3/8" self-tapping screws as shown.

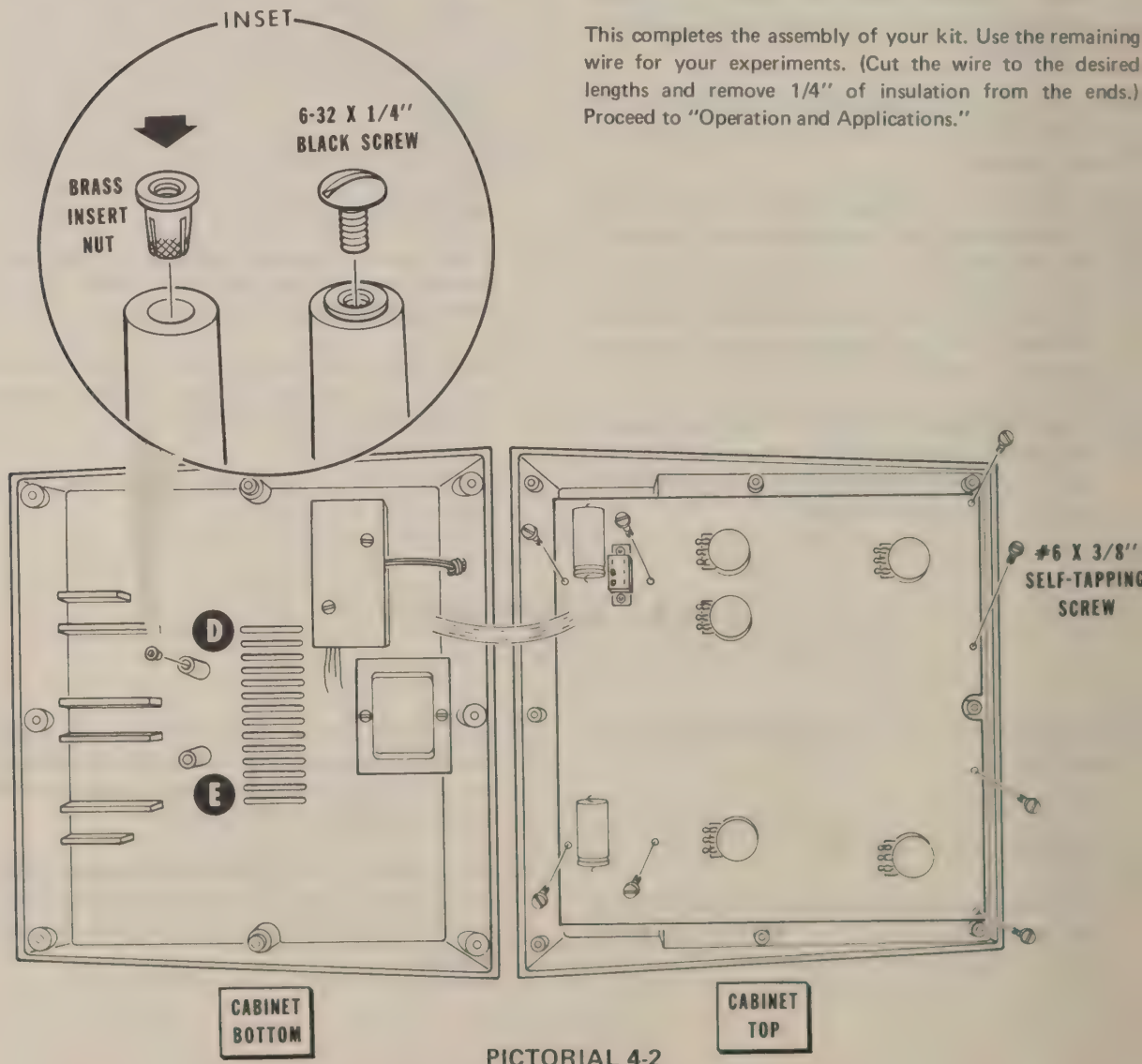
Refer to Pictorial 4-3 for the following steps.

( ) Mount the cabinet top to the cabinet bottom. Use two 6-32 x 1/4" black screws and eight #6 x 5/8" self-tapping screws.

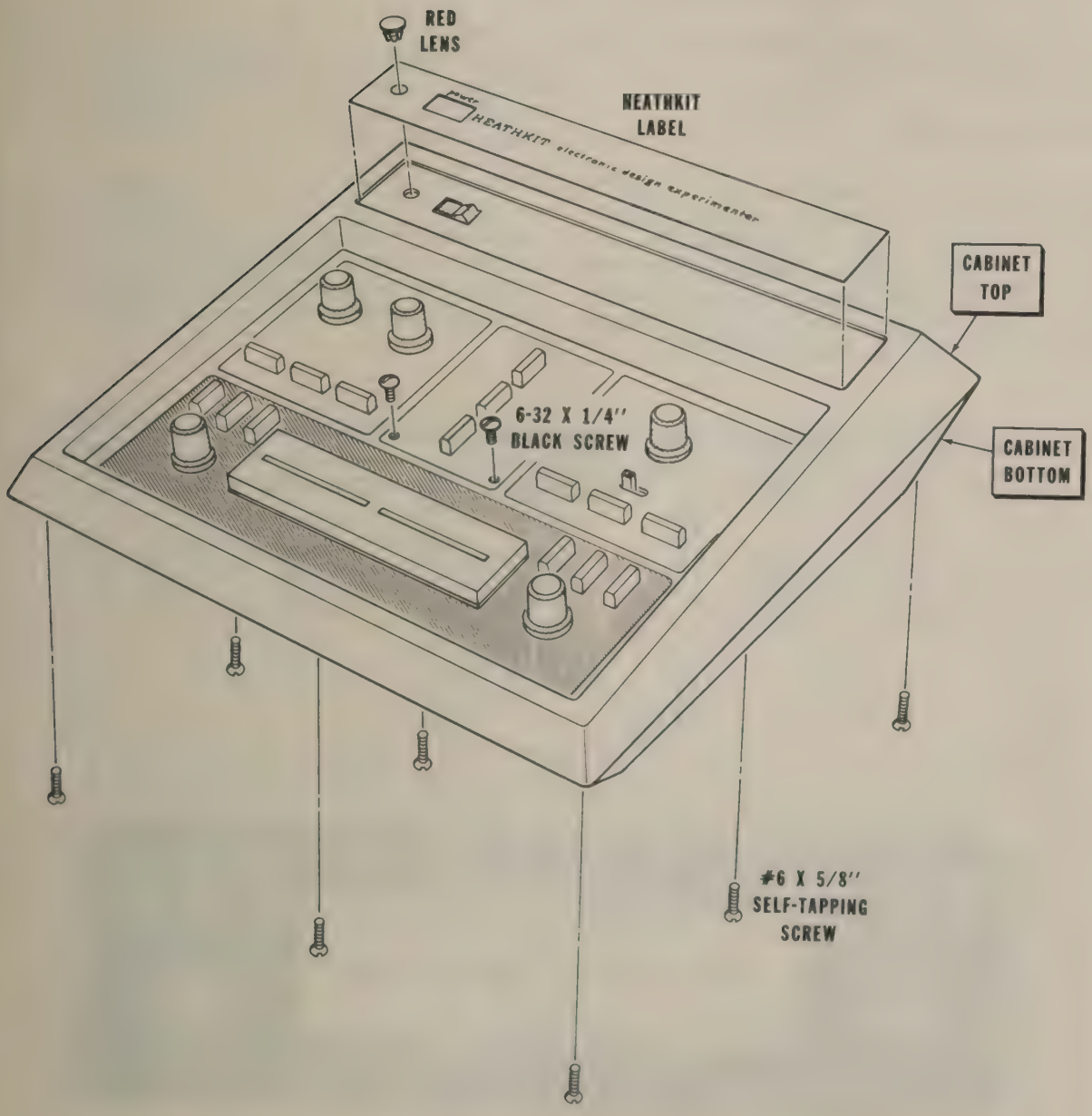
( ) Remove the protective backing from the Heathkit label and apply the label to the cabinet top as shown.

( ) Push the red lens into the indicated hole as shown.

This completes the assembly of your kit. Use the remaining wire for your experiments. (Cut the wire to the desired lengths and remove 1/4" of insulation from the ends.) Proceed to "Operation and Applications."



PICTORIAL 4-2



PICTORIAL 4-3

OPERATION AND APPLICATIONS

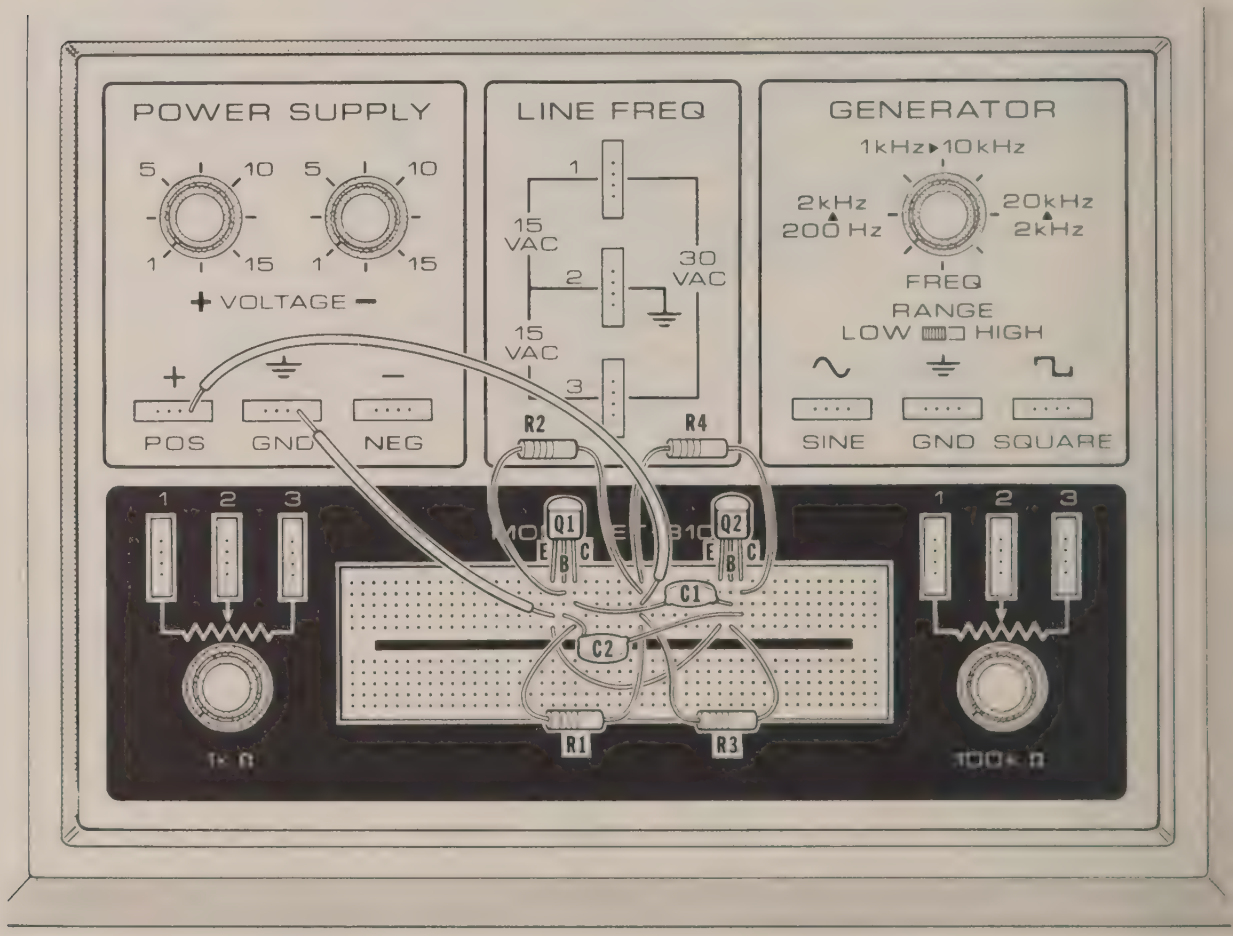
Figure 1 (in the Illustration Booklet) gives a brief description of each control function.

CONNECTOR BLOCK

The connector blocks are designed to accept up to #20 (.032") solid wire and most common sized component leads. The four connectors in the small connector blocks are internally connected together. Also each vertical row of five connectors in the breadboarding socket are connected together as shown in Figure 1. Thus, you can build simple or complex circuits without making solder connections.

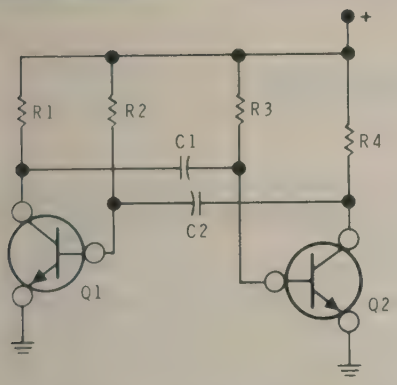
The Experimenter not only supplies positive (+) and negative (–) DC voltages, but also 15 and 30 volts AC, and both sine and square wave signals from 200 Hz to 20 kHz. Use the 1 kΩ and 100 kΩ controls whenever you need variable resistors or voltage dividers.

Experiments #1 and #2 are two examples of typical experiments. The first experiment uses transistors, and the second uses an integrated circuit. The breadboarding socket is designed to accommodate integrated circuits and the IC puller supplied in your kit fits down into the center channel of the breadboarding socket to gently and easily lift the IC out.

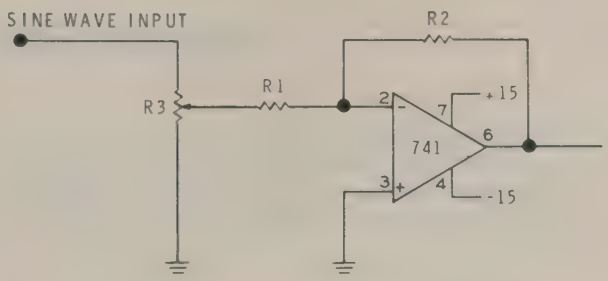


EXPERIMENT #1

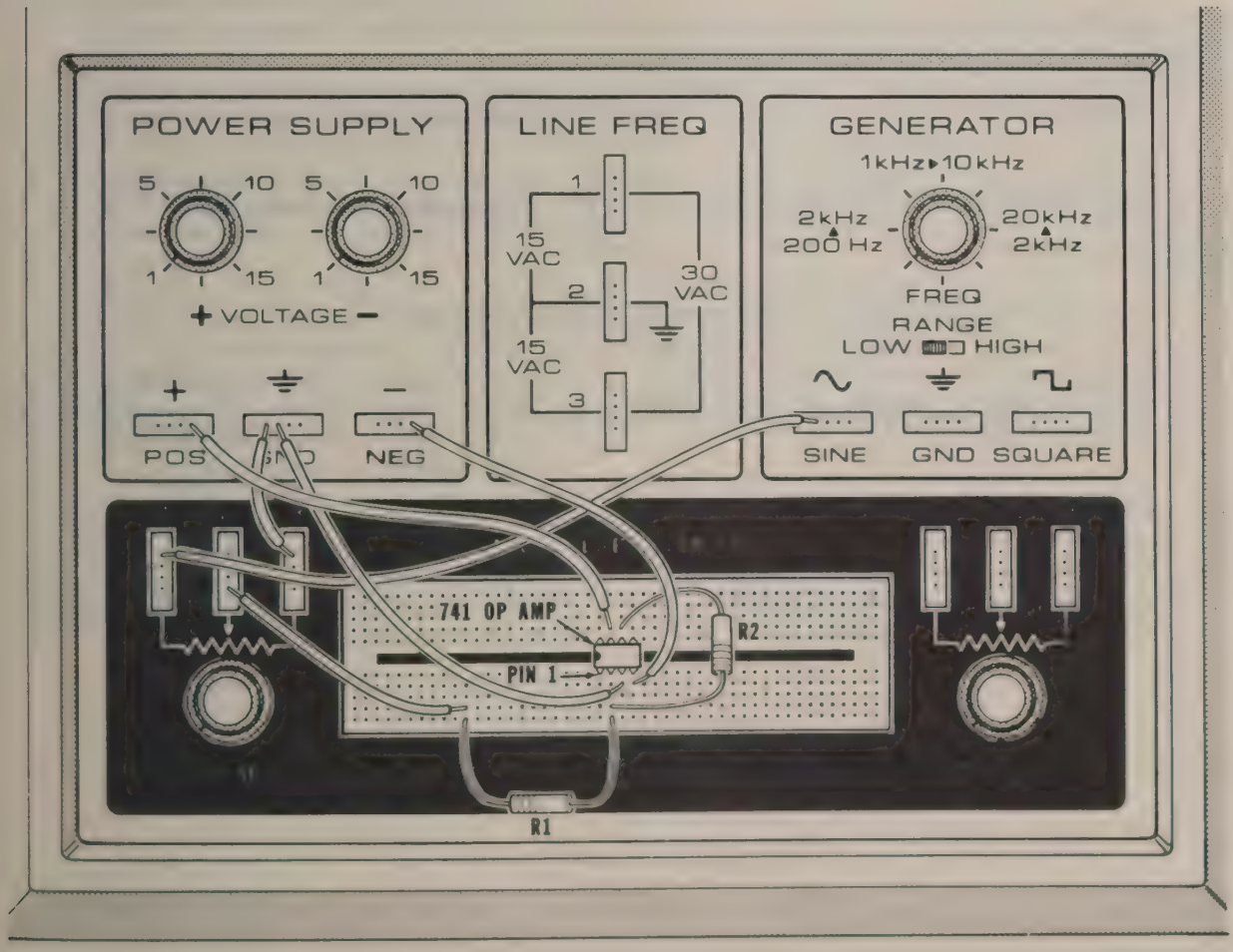
ASTABLE MULTIVIBRATOR



EXPERIMENT #1
ASTABLE MULTIVIBRATOR



EXPERIMENT #2
IC AMPLIFIER WITH GAIN CONTROL



EXPERIMENT #2

IC AMPLIFIER WITH GAIN CONTROL

IN CASE OF DIFFICULTY

Use the "Visual Tests" first to find a difficulty that shows up right after your kit is assembled. You can also use the "Troubleshooting Charts" right after your kit is assembled, or at some future time in case your Experimenter should ever malfunction.

If the trouble is still not located after you complete the "Visual Tests," and a voltmeter is available, check voltage readings against those shown on the "Voltage Chart" Page 32. Read the "Precautions" on this page before you make any measurements. NOTE: All voltage readings were taken with a high input impedance voltemeter.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

NOTE: Refer to the "Circuit Board X-Ray View" on Page 31 for the physical location of parts on the circuit boards.

VISUAL TESTS

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you constantly overlooked.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure they are soldered properly.

3. Check to be sure that all transistors are in their proper locations. Make sure each lead is connected to the proper point.

4. Check that each of the IC pins are properly installed in their connectors, and not bent or under the IC. Also be sure the IC is installed in its correct position.

5. Check the values of the parts. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial diagrams. It would be easy, for example, to install a 5600 Ω (green-blue-red) resistor where a 56 kΩ (green-blue-orange) resistor should have been installed.

6. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

7. A review of the "Circuit Description" may also help you determine where the trouble is.

PRECAUTIONS

1. Be cautious when you test IC and transistor circuits. Although they have almost unlimited life when used properly, they are quite vulnerable to damage from excessive voltage or current.

2. Be sure you do not short any terminals to ground when making voltage measurements. If the probe should slip, for example, and short out a bias or supply point, it is very likely to damage one or more IC's, transistors, or diodes.

TROUBLESHOOTING CHART

PROBLEM	POSSIBLE CAUSE
No output from either power supply.	1. Transformer T101. 2. Diode D101, D102, D104, or D105. 3. Fuse F101.
Unable to adjust positive voltage output — stays high.	1. Transistor Q101, Q102, or Q103.
Unable to adjust positive voltage output — stays low.	1. Transistor Q101 or Q104.
Unable to adjust negative voltage output — stays high.	1. Transistor Q105, Q106, or Q107.
Unable to adjust negative voltage output — stays low.	1. Transistor Q105 or Q108.
No signal output from signal generator.	1. Control R4 misadjusted. 2. IC1. 3. Connections at R1/R5.
Excessive distortion in signal generator.	1. Control R4 misadjusted. 2. IC1.

SPECIFICATIONS

POWER SUPPLIES

Positive Supply Output	1.2 to 15 volt DC, continuously variable.
Load Regulation	Better than 1%, no load to full load.
Current Output	100 mA with short circuit protection.
Negative Supply Output	–1.2 to –15 volts DC, continuously variable.
Load Regulation	Better than 1%, no load to full load.
Current Output	100 mA with short circuit protection.

SIGNAL GENERATOR

Range Selector Switch	LO, 200-2000 Hz, continuously variable. HI, 2000-20,000 Hz, continuously variable.
Sine Wave Output	1 volt rms from 600 ohms at less than 4% distortion.
Square Wave Output	15 volts peak-to-peak (+15 volts maximum, .1 volt minimum) with rise time less than 1 μ second and nominal duty cycle of 30%.
60 Hz Sine Wave Output	
Volts	15 and 30 volts rms.
Current	200 mA maximum (total current from all supplies must not exceed 200 mA).

GENERAL

Power Requirements	105-130 volts or 210-260 volts RMS, 50-60 Hz, 7 watts maximum.
Dimensions	12-1/8" wide x 11-3/4" deep x 3-1/2" high.
Net Weight	4 lbs.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (in the Illustration Booklet) while you read this "Circuit Description."

The signal generator consists of a Wein bridge oscillator (that produces a sine wave) followed by a signal amplifier. The sine wave output is then shaped to produce the square wave output. Power is supplied from the zener-regulated ±15-volts sources. These sources are references for other circuitry to produce the regulated and adjustable ±15-volts power supplies.

SIGNAL GENERATOR

The signal generator is a Wein bridge oscillator made with an integrated circuit operational amplifier. Feedback networks control the gain of the circuit and its oscillation. See Figure 2.

In the Wein bridge circuit, the output of the amplifier is fed back to the noninverting (+) input through a series-parallel resistor-capacitor network. At some particular frequency, depending on the values of resistance and capacitance in the network, the phase of the signal applied to the noninverting input will be identical to the output signal. However, the amplitude of the feedback signal is insufficient because of the voltage divider effect of the network. In order for the circuit to oscillate, the feedback signal applied to the noninverting input should have the same phase as the output signal and, in addition, the amplitude of the feedback signal must be high enough to sustain the output. To overcome the loss in output amplitude brought about by the RC network, the gain of the amplifier is set by feedback resistor R4 to exactly offset the loss in the feedback network.

While a conventional fixed resistor could be used for L1, the use of an incandescent bulb provides automatic gain control for the circuit. Because of the various circuit instabilities inherent in oscillator circuits, the gain of the circuit will vary widely and the output can easily become distorted. In order to maintain a pure sine wave output with no distortion, the gain of the circuit must be controlled to keep it stable. The incandescent bulb provides this automatic gain control since its resistance changes with the changes of current flowing through it. The resistance of the lamp increases as the current through it increases. If the output amplitude of the amplifier should attempt to increase, the current through L1 will also increase. This causes the resistance of L1 to increase and the gain of the circuit to decrease. The decrease in gain causes the output signal to decrease, thereby compensating for the initial increase.

Transistors Q1 and Q2 are complementary current amplifiers. The output from these transistors drives transistors Q3 and Q4 into saturation and thus produces a square wave from a sine wave.

POWER SUPPLY

The power transformer can be wired for either 120 volts AC or 240 volts AC. The secondary voltage is rectified by diodes D101, D102, D104, and D105; and filtered by capacitors C101 and C111 to provide filtered DC for the positive and negative power supplies. Because the power supplies are similar, only the positive supply will be explained.

The positive 15-volt source is established by 15-volt zener diode ZD101. Resistor R104 limits the current to a safe value, and capacitor C102 adds filtering.

Control R106 selects the desired portion of the 15-volt reference. If the output of the power supply changes, transistor Q103 conducts more or less and, in turn, controls Q101 and Q102 so the output remains constant.

If the output current becomes excessive, the voltage drop across R107 turns on transistor Q104. This reduces the voltage at the base of Q101, which starts to turn off Q102 and limit the output current to a safe value.

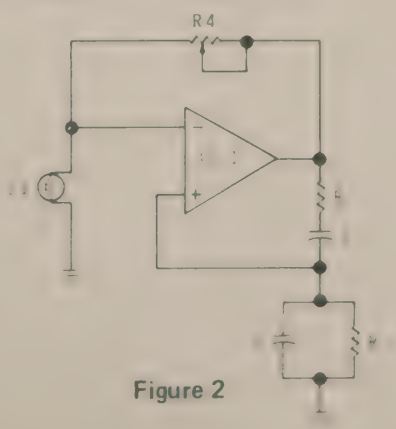


Figure 2

CIRCUIT BOARD X-RAY VIEW

(IN ILLUSTRATION BOOKLET)

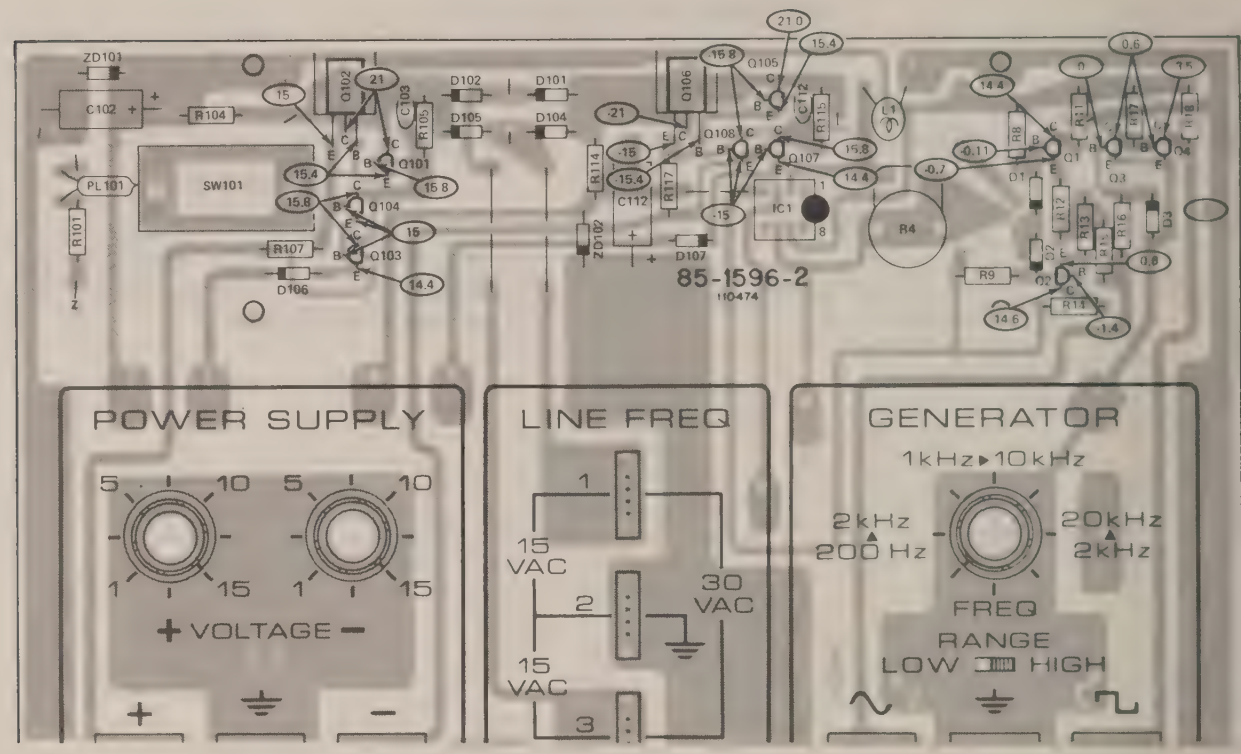
NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R5, C3, etc.) on the "X-Ray View."

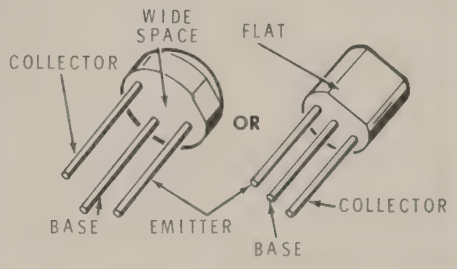
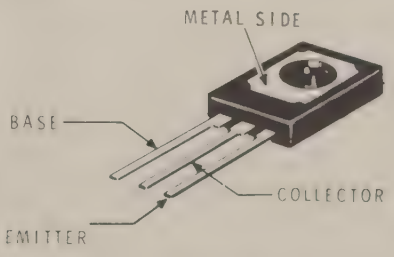
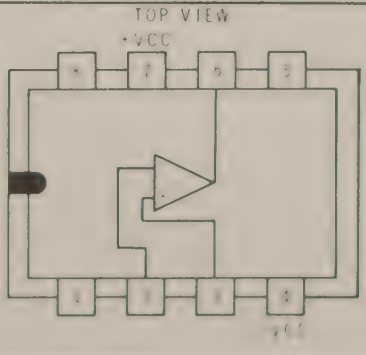
B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

VOLTAGE CHART



IDENTIFICATION CHART

CIRCUIT COMPONENT NO.	HEATH PART NUMBER	MANUFACTURER'S NUMBER	BASE DIAGRAM
D1, D2, D3, D106, D107	56-56	1N4149	
ZD101, ZD102	56-620	15-VOLT ZENER	
D101, D102, D104, D105	57-65	1N4002	
Q2, Q105, Q107, Q108	417-235	2N4121	
Q1, Q3, Q4, Q101, Q103, Q104	417-801	MPSA20	
Q102	417-818	MJE181	
Q106	417-819	MJE171	
IC1	442-22	N5741V, or MC1741CPI, or µA741TC, or LM741CN	

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
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CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH ZENITH

MP MASTER
MA22885

HEATH COMPANY • BENTON HARBOR, MICHIGAN

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